

# Head On<sup>TM</sup> 2

# INVINCIBLE

MANUFACTURED BY

Gremlin<sup>®</sup>/SEGA<sup>®</sup>

MANUAL PART NO. 420-0359

## OWNER'S MANUAL

HEAD ON 2  
&  
INVINCO  
DUAL GAME MANUAL

HEAD ON2/INVINCO OWNER'S MANUAL

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## INTRODUCTION

This is an electronic game that makes extensive use of digital integrated circuitry and television monitor circuitry. This manual assumes the maintenance technician possesses a general knowledge of solid state circuitry, microprocessor, TTL digital integrated circuitry and T.V. monitor concepts. Any individual NOT knowledgeable in these areas SHOULD NOT attempt repair of the electronic portion of this game. IT SHOULD BE NOTED THAT ANY ATTEMPT TO REPAIR THE GAME IN THE FIELD WITHOUT EXPRESS CONSENT OF THE FACTORY WILL IMMEDIATELY VOID THE WARRANTY!!!

### IMPORTANT NOTES:

- NEVER replace any components with anything other than exact replacement parts. (See Parts List located on Service Schematics.
  - NEVER remove circuit boards/connections while power is on.
  - DO NOT replace the fuse with anything other than the proper value. A blown fuse indicates an overload condition within the game. Replacing the fuse with a higher value can cause severe damage to internal components if an overload occurs.
  - ALWAYS consult the manual before attempting repairs.
- CORRESPONDENCE regarding this game should be addressed to:

GREMLIN INDUSTRIES, INC.

8401 Aero Drive

San Diego, California 92123

(714) 277-8700

### IMPORTANT NOTE

An important service note is posted in this game and is repeated here for emphasis:

IF AT ANY TIME THE T. V. SCREEN SHOWS A MEANINGLESS DISPLAY  
OR THE GAME OTHERWISE MALFUNCTIONS, SIMPLY DROP A COIN INTO  
THE COIN MECHANISM. THIS SHOULD CORRECT THE PROBLEM. IF  
NOT, THE GAME REQUIRES SERVICE.

The circuitry in this game has been arranged so that the insertion of a quarter through the coin mechanism will reset the system. This clears up temporary problems caused by power line disturbances, static, etc.

### SERVICE TECHNICIAN NOTE:

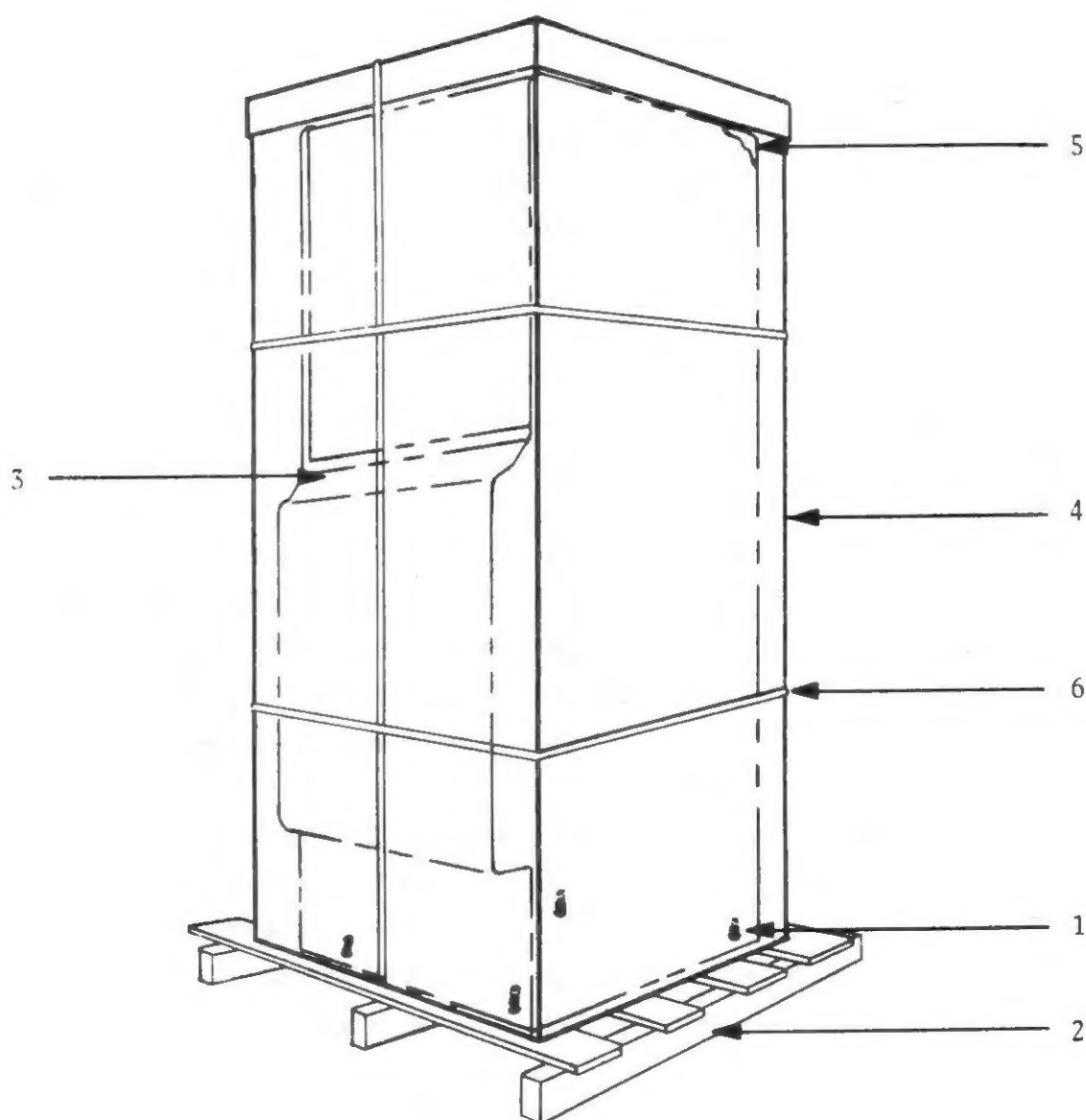
The system reset circuitry described above requires that the coin counter is attached to the system. If there is a coin counter problem and no replacement is available, the game will function properly if a 10K Ohm resistor is connected across the coin counter input pins to the video logic board.

## REPACKAGING INSTRUCTIONS

Should it be necessary to ship this game, follow the instructions below for game recrating:

- A) If the original shipping bolts have been discarded (Ref.1), obtain four 5/16-18x1 3/4" hex head bolts with 5/16" flat washers. Carefully lay the game on its side and attach skid (Ref.2).
- B) Place game upright. Tape game keys to upper flange of operator's panel (Ref.3). Crate the game using appropriate shock-absorbent packing material (Ref.4). Include padding on all four corners of the game (Ref.5). After crating is completed, secure package with strapping (Ref.6).

NOTE: If the game is to be shipped to GREMLIN for service or repair, attach a tag identifying the distributor and indicate the service or repair to be made; include the full serial number of the game. GAME MUST BE SHIPPED PREPAID.





## HEAD ON 2-GAME CONCEPT

The most noticeable change on Gremlin's new HEAD ON 2 game, is the addition of two turn-around lanes on either side of the screen. With these turn-around lanes, HEAD ON 2 becomes a different game, even more challenging and exciting.

The game begins by displaying the following information on the screen:

BONUS  
200  
POINTS PER ... = 5  
POINTS PER ♦♦ = 10

The computer's car and the player's car start at the bottom of the screen. When the player clears all lane markers against one computer car, he is awarded the 200 BONUS points and then is pitted against 2 computer cars. After clearing the lane markers again, 3 computer cars appear. Finally, 4 computer cars are the maximum amount that drive against the player. Each time a player clears all lane markers, the BONUS POINTS value is increased, so that more bonus points are awarded for beating 2 computer cars than for beating 1. In addition, the POINTS PER dot/diamonds values increase each time the bonus is awarded.

In HEAD ON 2, the player now has a few more lane options open to him in order to gain the most points and avoid a collision with the computer car. For example, if the player reverses his car's direction by passing through a turn-around lane, he then becomes either the pursuer or the pursued. If he is pursued by the computer car, the player must be careful to avoid a rear-end collision. If the player is following a computer car, he must again watch for a possible rear-end collision into the computer car. The different possibilities are what makes HEAD ON 2 an even more challenging and strategy-demanding game.

Also, each game is different from the next. While it is tempting to find a winning pattern, the game will not necessarily respond the same way every time. Because of the varied combination of action, a working pattern for one game may not work for the next. This feature will keep them playing game after game; and, each time, new video excitement is there for all players.

Refer to the OPTIONS section of this manual for instructions on changing the number of player cars.

## INVINCO GAME CONCEPT

INVINCO is a fast-paced Gremlin Multi-Phase game that pits the player against a attacking force of numerous enemy warriors.

The player begins with three Prime Defenders which are released one at a time behind the defense barrier. The enemy warriors immediately begin to advance, firing missiles as they approach. In order to destroy them the player must blast away the barrier in strategic places, exposing the columns of warriors to his own missiles. The player then proceeds to destroy as many warriors as possible while dodging their attacking missiles. The warriors in the back rows are worth more points and each warrior in the very last row must be hit three times (becoming smaller after each hit) before it is finally destroyed. If the player aims carefully enough, he may hit one warrior behind another. This will cause that warrior to explode, taking nearby warriors with it. For an even higher score the player may try to hit the large bonus targets which sweep intermittantly across the backfield.

If during this time the player's Prime Defender is hit by enemy fire, it will explode and another will take its place. This continues until all three Prime Defenders are destroyed and the game ends. If the Prime Defenders are not destroyed and the player clears the entire field of enemy warriors, INVINCO will send out the "Avenging Spirit," a large target which manuevers wildly as it fires its missiles in a last ditch effort to destroy the Prime Defender. If the player clears the field a second time, two Avenging Spirits will descend; after the third clearing the player will face three. Thus the difficulty is intensified as the player's skill increases.

## OPTIONS SELECTION INSTRUCTIONS:

Your H02/INVINCO game is adjustable for different numbers of player cars and player firing bases. The following chart shows how to change these: (Locate the 6-position DIP switch on the logic board. This switch selects the desired number)

### HEAD ON 2

<u>#of cars desired</u>	<u>position on DIP switch</u>
2	switches 1 and 2 up
3	switch 1 up
4	switches 1 and 2 down

### INVINCO

<u># of firing bases</u>	<u>position of DIP switch</u>
3	switch 4 up
4	switch 3 up



### SPECIAL NOTE: NEW GAME BOARDS AND NEW EPROMS

The following chart shows the two kinds of logic boards Gremlin will use in future games. These will be either a SINGLE VIC board or a DUAL VIC board. Also shown are the possible combinations of Eprom types that Gremlin will be using. The 2 Eprom types are

- 1) 2708 (holds 8K of memory)
- 2) 2716 (holds 16K of memory)

Obviously, the 2716 holds twice as much information as the 2708, BUT the 2 Eproms are NOT directly compatible-- in other words, you have to replace a 2716 with another 2716, and a 2708 with another 2708. In addition, the 2716 Eprom socket is modified slightly to accept the 2716 Eprom. If it is ever necessary to replace a new Eprom, be sure to specify "2708" or "2716". These numbers are printed on the Eprom package.

<u>Logic Board Type:</u>	<u>Possible Eprom Types Used:</u>	<u>Where Used:</u>
SINGLE VIC board (see Figure 1)*	1) all 2708's	HEAD ON 1 HEAD ON 2 <b>Future games</b>
	2) 2708's and 1 2716 (used in combination)	INVINCO DEEP SCAN Future games
<hr/>		
DUAL VIC board (see Figure 2)*	1) all 2708's	Any dual game Future games

The reason for using both types is that some game programs are larger than could be contained in a set of 2708's. So, usually one 2716 provides enough additional memory space to hold a longer program.

\* Figures 1 and 2 show each of the two types of Gremlin logic boards. The boards in the photos are labelled for easy identification of all external connections.

SPECIAL NOTE: POWER SUPPLY MODIFICATIONS: For DUAL VIC Logic Boards ONLY

In order to supply -5 volts to the DUAL VIC logic board, it was necessary to modify the game power supply. The modification simply adds a 7905 -5 volt regulator (Gremlin part #313-0023) to the power supply chassis; the 7905 is connected into the -12 volt line at pin 11 of the power supply output connector. PIN 17 OF THIS CONNECTOR NOW BECOMES THE -5 VOLT OUTPUT. The other pins remain the same:

pin 11= -12v  
pin 12= +12v  
pin 13= 2-3 V AC signal  
pins 14,15,16 = GROUND  
pin 17= -5v  
pins 18,19,20= +5v

Also, a 8900 ufd filter capacitor has been added to the power supply to provide better +12 volt regulation.

TRANSFORMER VOLTAGE CONVERSION INSTRUCTIONS:

To convert the game transformer to 100, 115, or 230 VAC, refer to the following chart:

- \*For 100 volts: Connect the voltage INPUT lines to transformer terminals 1 and 2.
- \*For 115 volts: Connect the voltage INPUT lines to transformer terminals 1 and 3.
- \*For 230 volts: Connect the voltage INPUT lines to transformer terminals 1 and 4. The fluorescent lamp line must be connected to transformer terminal 3.

ALSO, THE TV MONITOR MUST BE CONVERTED TO THE SAME VOLTAGE INPUT AS THE GAME TRANSFORMER. REFER TO THE MONITOR MANUAL IN THE GAME.

## MAINTENANCE PROCEDURES

### I. Power Supply (Refer to drawing #815-0020, sheet 4)

1. Remove output connectors from power supply.
2. Make these initial tests: (GND to BLACK lead on C18, 9000 ufd capacitor)
  - a. +9 VDC on POSITIVE terminal of C18
  - b. +17-19 V on C6 (4700 ufd cap.)
  - c. -17-19 V on C5 (4700 ufd cap.)
  - d. -12 V at output pin 11 (adjustable by trim pot R42)
  - e. +12 V at output pin 12 (adjustable by trim pot R8)
  - f. +5 V at output pins 18,19,20 (adjustable by trim pot R9)
  - g. GND (ground, 0 V) at pins 14,15,16
  - h. 2-3 V AC at pin 13 (Don't forget to change meter scale to AC)
  - i. -5 V at pin 17
3. Check these voltages again with the logic board connected. If any are wrong, a loading condition exists in the logic board, most likely.

### II. Logic Board

The following instructions will help you trace down and find most problems associated with the logic board. The procedures are listed by the more common kinds of problems that could arise. Read through all the steps first, then apply them one at a time. The necessary equipment are an oscilloscope and AC/DC voltmeter.

#### 1. NO PICTURE: TV TUBE AND FLUORESCENT LAMP ARE OFF

- a. Plug the game in and check to see that it is receiving 115 (230) VAC. Measure 115 VAC at the input terminals of the game transformer. If it is not present here, proceed to next step.
- b. Check the fuse; if it is good, proceed to next step.
- c. Remove the cover of the junction box in back of the game. Measure 115 VAC on the output of the line filter. If it is not present, the line filter may be bad. Or, one of the AC line connections in the junction box may be loose. UNPLUG the game and re-check these connections.
- d. If the fluorescent lamp still does not operate, turn off game and on again. This usually re-starts the lamp. If it doesn't, turn the lamp in its socket; this will re-seat it for a better connection. Sometimes the lamp works loose during shipment.
- e. An ON/OFF switch for the TV monitor is located on the TV chassis, below the neck of the picture tube. Make sure it is ON.

#### 2. NO PICTURE: TV TUBE AND FLUORESCENT LAMP ARE ON. SCREEN BLACK.

- a. First, make a quick check of the monitor-to-logic board connections: Are all wires making contact with the pin connector? Are the wires secure on the monitor plug-in connector?

- b. Check to be sure U14 is seated in its socket properly, and that no pins are bent. This IC is a Prom that develops the necessary video timing sequences. Usually if one pin on the chip is out of the circuit, the screen will appear black. Proceed to next step if this chip is seated correctly.
- c. Inspect the high-voltage lead coming off the monitor's high-voltage transformer. This lead attaches directly to the TV tube. Sometimes, during shipment, this wire is jostled out of contact with the transformer. Turn off the game, and carefully push the wire down, toward the transformer, to re-seat it. Now check to see if the picture comes on. If it doesn't, proceed to step d.
- d. Using a voltmeter, measure the three voltages powering the logic board. These voltages, +5, -5, +12 volts can easily be measured at the power supply-to-logic board connection. If all the voltages are present, go to next step.
- e. Using an oscilloscope, test for clock signals at the following points: (For the moment, don't worry about what each signal should look like: We're concerned with finding floating signals, and/or signals that are not present when they should be, and why they are not.) The scope setting is .2v/div. @ 5usec., with a 10:1 probe. All clock signals, except the video signal, are about 5 volts in amplitude.

- \* Check pin 6 of U50. Look for a 1½-2 volt video signal. If not there, check pin 4 of U50. If it is here, U50 is probably bad.
- \* If the signal is not at pin 4 of U50, suspect U57 and U67.
- \* Check the following IC's and pins for any floating or missing signals: U13, pin 8. U22, pin 9. U15, pins 11,12,13,14. U14, pins 1-7, 9. U19, pins 2,6,10,15. U20, pins 2,7,10,14,15. These chips make up the video timing circuit. Make sure there are no floating or missing signals on any of these chips. If there are, suspect the chip is bad.

### 3. PICTURE APPEARS: COLOR IS DISTORTED; SOME COLORS MISSING

- a. Check the red, blue, and green output signals on U67, pins 4,7,9, respectively. If no signals present, suspect U67, U49, or U66.

### 4. INCOMPLETE PICTURE: RANDOM DISPLAY

- a. Sometimes the game appears on the screen with parts of the picture showing incorrect information. For example, the "HI SCORE" listings display jumbled information, while the rest of the picture is normal. The most likely cause of this problem is one of the 8 Ram IC's U69 through U76. The quickest way to find the bad Ram is simply to replace each IC, one at a time, with knowngood Rams. Be sure not to bend any pins when replacing the IC's. Also, don't overlook the possibility that one of the Ram sockets is bad.

### 5. RANDOM DISPLAY WHEN GAME IS TURNED ON

- a. Activate the coin switch a few times to see if this clears the picture. If not, turn the game off, then on again. If the jumbled display still appears, proceed to step b.
- b. Check the reset circuit on the logic board. (Refer to the schematic)

When power is first applied to the game, a reset circuit consisting of Q1, Q2, U18 and U35 is triggered on to reset the microprocessor. This reset signal forces the microprocessor to start at the beginning of the game program. If the microprocessor is not reset, it will still operate—it just won't operate on the right program instructions or data, and will continually display a jumbled pattern on the screen. So, begin by checking for a 3-4 VAC signal at pin 3 of the power supply-to-logic board connector. Follow the signal through Q1, where, at the collector, a sawtooth wave appears. Then, when power is first applied, observe pin 2 of U18 as capacitor C10 slowly charges to about 3 volts. When this level is reached, U18 is triggered to change states, causing pin 3 to go high, then low. This change is inverted by U17 and finally reaches pin 26 of the Z80. Check pin 26 of the Z80 for a low-to-high signal change. If not present, one or more of the reset circuit components is bad. If it is present, proceed to step c.

c. The following lists some probable causes of the jumbled display pattern:

- \* one or more RAMs
- \* one of the Eproms, U1-8, U26-33
- \* The microprocessor, U 16, is bad.
- \* U47 (74LS245) is bad.
- \* U51 and U52 are bad.
- \* Check the 3 operating voltages, +5,-5, +12 VDC.

#### 6. GAME DOES NOT COIN UP

- a. A common problem with a game that does not coin up is that the coin switch trip wire is out of adjustment. Usually, all that is necessary is to bend the trip wire up or down, depending on whether a heavier or lighter tension is needed.
- b. There may be a problem in the coin circuit on the logic board. Check U62, pins 6,8 for pulses each time the coin switch is tripped. Also, U43 and/or U62 may be bad. Suspect U45, also.
- c. It is possible that one of the coin counter transistors, Q3 and Q4, is bad. Determine whether or not the counter advances each time the coin switch is tripped.
- d. Don't overlook an incorrect or faulty coin switch-to-logic board connection; sometimes these wires work loose from the coin switches.

#### 7. PLAYER CONTROLS NOT WORKING

- a. Check first to be sure all control switch connections are secure. This includes checking the black wires, or ground leads.
- b. If these connections are good, make sure the control panel leads are intact inside the Molex<sup>™</sup> connector to the logic board.
- c. If the controls still do not work, suspect U44 on the logic board. However, U44 could be good but might not be receiving the activating pulses from U24, pin 10 or U25, pin 12. Check these also.

#### 8. GAME'S SOUNDS NOT HEARD

- a. Check to be sure the sound board output leads are making good contact on the GAME SELECT SWITCH located on the control panel. Also, make sure the audio lead from this switch is connected to the power supply/amplifier board properly. (Refer to the game wiring schematic)
- b. If these connections are good, check the power supply/amplifier board for any audio signals. Specifically, check U4, Q8, Q9 on the amplifier board for any game sounds.
- c. If there are none here, suspect U63 and U64 on the logic board. Also, check U23 for the pulses that turn on U63 and U64.
- d. If these chips appear good, the sound boards are probably bad. Refer to the sound board schematics for each sound's circuit.

The following chart lists the sound type and corresponding sound board pin numbers:

HEAD ON:	<u>Sound type</u>	<u>Sound board pin #</u>
	Crash	1
	High speed player car	2
	Car sound on	3
	High speed computer car	4
	Audio output	5
	Screech #1	6
	Screech #2	7
	Bonus	8
INV INCO:	Ship hit	2
	UFO hit	3
	Laser	4
	UFO 1	6
	Saucer	8
	UFO 2	7
	Audio out	22
DEEP SCAN:	Bonus sub.	1
	Sonar	3
	Score bonus	4
	Water spray	5
	Depth charge explosion	10
	Sub explosion	11
	Ship explosion	12
	Audio out	15



# RECOMMENDED SPARE PARTS LIST- DUAL GAMES

Gremlin Part #:	Description:	Quantities per 10 games:
130-0001	speaker	1
130-0002	speaker cover	1
200-0011	Algo1 color monitor	1
253-0104	Plexi front monitor panel	1
253-0120	panel logo, H02/INVINCO	1
253-0121	" " H02/DEEP SCAN	1
253-0123	" " DEEP SCAN/INV	1
390-0011	fluorescent lamp	2
220-0008	coin counter	1
220-0035	coin door lock and key	2
220-0066	coin mechanism, complete	2
220-0071	coin reject button&spring	3
220-0072	coin return stop (U-bolt)	3
475-0007	volume control	1
510-0014	slide switch	1
510-0042	coin switch	3
510-0051	push button switch	1
(800-0076)	photo coin assy.	
270-0001	line filter, junction box	1
514-0001	fuse, 2A, slo	5
240-0007	black pushbutton control	3
510-0023	mounting/contacts for above	3
510-0050	game select switch	3
800-0056	complete joystick	2
240-0091	joystick knob	3
250-0289	threaded rod	3
250-0291	upper sleeve	3
510-0041	joystick switch	5
315-0019	2708 Eprom, blank specify by number on Eprom	1 set
315-0050	2716 Eprom specify by number on Eprom	1 set
316-0246	color prom INV/DS	1
316-0287	color prom H02/INV	1

	color prom H02/DS	1
	color prom INVINCO	1
	color prom DEEP SCAN	1
314-0001	555 IC	5
314-0093	74LS374 IC	3
314-0099	74LS245	3
314-0104	74LS138	3
314-0105	74LS253	3
315-0031	Z80 microprocessor	2
315-0039	RAM IC	10
315-0042	Video Interface Chip (VIC)	3
316-0206	video timing prom	3
475-0002	resistor pack	3
482-0010	PE8050 transistor	3
482-0014	2N4401 "	10
510-0043	6-position DIP switch	2
(The following are suggested parts for all sound boards:)		
313-0008	LM348 IC	5
314-0042	7406 IC	5
315-0006	CMOS 4017 IC	5
315-0035	MM 5837 IC	5
315-0043	CMOS 4069 IC	5
481-0006	1N914 diode	10
481-0008	1N5231 Zener diode	10
482-0006	2N4403 transistor	10
482-0023	2N4093 "	10
313-0004	LM741 IC	5
315-0005	CMOS 4013 IC	5
315-0009	CMOS 4081 IC	5

Grossman Industries, Inc. San Diego, California 92123			PARTS LIST		TITLE ASSY DUAL GAME V.I.C.		800-0058 DWG NO		SH 2 OF 8		C REV	
ITEM NO	PART NO	QTY PER ASSY				DESCRIPTION	REF DES					
1	151-0005	1				CAP CER 680 pf 50V	C12					
2	151-0011	4				CAP CER .01 $\mu$ f 50V	C73, C74, C41, C42					
3	151-0012	64				CAP CER .1 $\mu$ f 50V	C12, 45, 311, 13-40, 43-72					
4	152-0001	1				CAP FILM .1 $\mu$ f 100V	C75					
5	153-0001	3				CAP TANT 10 $\mu$ f 25V	C3, C6, C10					
6	153-0002	1				CAP TANT 1 $\mu$ f 25V	C9					
7	153-0008	1				CAP TANT 100 $\mu$ f 20V	C8					
8	170-0174	1				P C BOARD						
9	211-0004	6				CONN PIN TEST PT	TP1 - TP6					
10	212-0004	2				CONN M 4 PIN						
11	212-0021	4				CONN M 10 PIN						
12	212-0031	3				CONN M 12 PIN						
13	213-0004	11				SKT 16 PIN DUAL INLN	XU14, 49, 69-76, X5W1					
14	213-0005	2				SKT 40 PIN DUAL INLN	XD16, XU57					
15	213-0001	16				SKT 24 PIN DUAL INLN	XU1-XU8, XU26-XU33					
16	230-0009	1				XTAL CLK 15.46848MHz	Y1					
17	314-0001	3				IC NE555	U18, U36, U37					
18	314-0015	1				IC 7404	U17					
19	314-0018	2				IC 74LS00	U23, U62					
20	314-0019	2				IC 74LS04	U25, U68					

Gresheim Industries, Inc. San Diego, California 92121			PARTS LIST		TITLE ASSY DUAL GAME V.I.C.		800-0058 DWG NO		SH 3 OF 8		C REV	
ITEM NO	PART NO	QTY PER ASSY				DESCRIPTION	REF DES					
21	314-0040	4				1C 74LS125				U51,U52,U54,U55		
22	314-0046	1				1C 74LS04				U13		
23	314-0058	5				1C 74LS08				U10-U12, U135,U56		
24	314-0059	1				1C 74LS10				U77		
25	314-0062	4				1C 74LS74				U22,U43,U58,U65		
26	314-0070	1				1C 74LS86				U50		
27	314-0072	2				1C 74LS174				U53,U66		
28	314-0073	2				1C 74LS175				U19,U20		
29	314-0076	1				1C 74LS157				U67		
30	314-0078	1				1C 74LS02				U24		
31	314-0099	1				1C 74LS245				U47		
32	314-0093	2				1C 74LS374				U63,U64		
33	314-0104	2				1C 74LS138				U9,U34		
34	314-0105	3				1C 74LS253				U44-U46		
35	314-0086	1				1C 74LS163				U15		
36	315-0031	1				1C Z80 CPU				U16		
37	315-0039	8				1C RAM 4K D O/SPEC 12M				U69-U76		
38	315-0042	1				1C VIDEO INTERFACE				U57		
39	316-0206	1				1C PROM 32X8 CTL				U14		
40	390-0003	1				LED RED				D2		

Greenline Industries, Inc. San Diego, California 92123			PARTS LIST		TITLE ASSY DUAL GAME V.I.C.		800-0058 DWG NO		SH 4 OF 8		C REV	
ITEM NO	PART NO	QTY PER ASSY				DESCRIPTION	REF DES					
41	471-0101	1				RES 100 OHM 1/2W 5%	R5					
42	471-0102	14				RES 1K OHM 1/2W 5%	R11-R13 19-24, 26-28, 39, 40					
43	471-0103	3				RES 10K OHM 1/2W 5%	R10, R34 R35					
44	471-0104	3				RES 100K OHM 1/2W 5%	R1, R2, R7					
45	471-0183	2				RES 18K OHM 1/2W 5%	R30, R36					
46	471-0220	3				RES 22 OHM 1/2W 5%	R14-R16					
47	471-0221	1				RES 220 OHM 1/2W 5%	R33					
48	471-0331	7				RES 330 OHM 1/2W 5%	R3, R4, R6, R17, R18, R31, R32					
49	471-0471	1				RES 470 OHM 1/2W 5%	R8					
50	471-0472	2				RES 4.7K OHM 1/2W 5%	R9, R37					
51	475-0001	1				POT 10K CAR PCMTV	R38					
52	477-0002	2				RES PACK 15 X 2.2K	RPI, RPZ					
53	481-0001	1				DIODE 1N4002	D4					
54	481-0006	2				DIODE 1N914 / 1N4148	D1, D3					
55	482-0010	1				XSTR PE 8050	Q3					
56	482-0014	4				XSTR 2N4401	Q1, Q2, Q4, Q5					
57	510-0043	1				SWITCH 6 POS DIP	SW1					
58	152-0007	2				CAP FILM .001 $\mu$ f 250V	C76, C77					

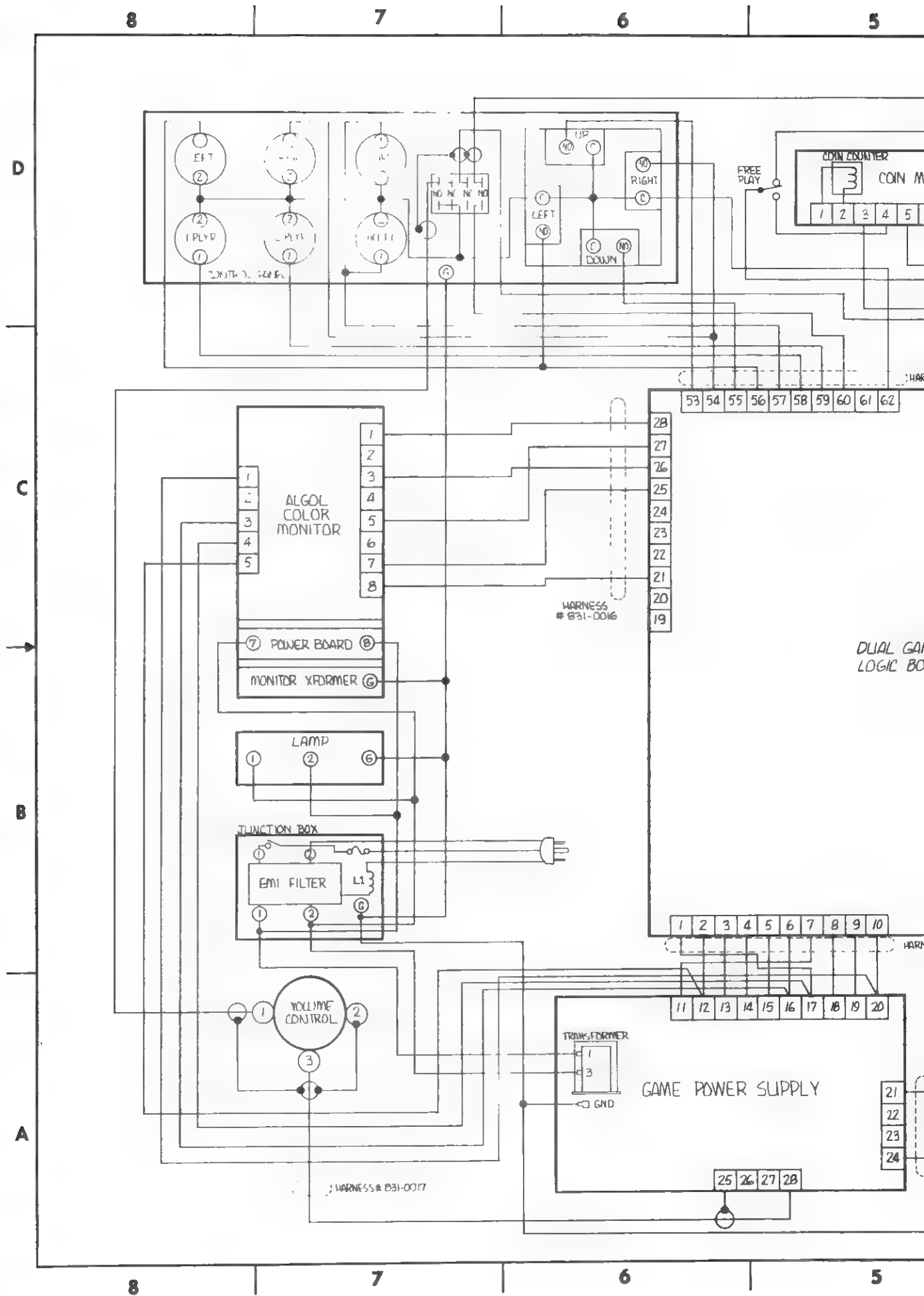
Gresheim Industries, Inc. San Diego, California 92123		PARTS LIST	TITLE HEAD ON SOUND		822-0002		SH 1	OF 6	REV
SHT 5 & 6 "D" SIZE		DRAWN Wynne 11-9-78		ENGR					
		CHECK Steve & Fay 12-22-78		APPR					
LTR	DATE	REVISION DESCRIPTION			DRAFT	CHECK	APPR		
A	1-6-79	RELEASED			WJB	[Signature]	[Signature]		
B	1-25-79	ECN 273 ADDENDUM 273 2-12-79			KB	[Signature]	[Signature]		
C	5-7-79	PER ECN 308			SB	[Signature]	[Signature]		



Crescent Industries, Inc. San Diego, California 92122		PARTS LIST	TITLE HEAD ON SOUND		DWG NO 822-0002	SH 2 OF 6	REV CM
ITEM NO	PART NO	QTY PER ASSY		DESCRIPTION	REF DES		
1	151-0001						
2	151-0001	6		CAP CER .01 $\mu$ f 50V	C8,13,17,32,21,22		
3	151-0002	5		CAP CER .1 $\mu$ f 50V	C5,C12,C26,C27,C35		
4	152-0001	3		CAP FILM .1 $\mu$ f 100V	C31,C20,C25		
5							
6	152-0012	3		CAP FILM .047 $\mu$ f 200V	C2,C23,C24		
7	152-0018	3		CAP FILM .01 $\mu$ f 250V	C3,C6,C19		
8	152-0020	3		CAP FILM .47 $\mu$ f 100V	C1,C18,C16		
9	153-0001	7		CAP TANT 10 $\mu$ f 25V	C10,C11,C28-C30,C33,C34		
10	153-0002	2		CAP TANT 1 $\mu$ f 25V	C4,C9		
11	153-0003	2		CAP TANT 2.2 $\mu$ f 25V	C14,15		
12	153-0004	1		CAP TANT 4.7 $\mu$ f 25V	C7		
13	170-0154	1		PCB HEAD ON SOUND			
14	212-0031	1		CONN M 12 PIN	P1		
15	313-0004	1		IC LM741 EN DIP	U3		
16	313-0008	1		IC LM348 DIP	U1		
17	314-0001	5		IC NE555 DIP	U2,U4,U9,U12,U14		
18	315-0005	4		IC 4013	U5-U8		
19	315-0009	1		IC 4081	U11		
20	315-0035	1		IC MM5837	U13		
21	315-0043	1		IC 4069	U10		

Greenlin Industries, Inc. San Diego, California 92123			PARTS LIST	TITLE HEAD ON SOUND		822-0002 DWG NO	SH 3 OF 6	CM REV
ITEM NO	PART NO	QTY PER ASSY		DESCRIPTION	REF DES			
22	471-0101	2		RES 100 OHM 1/2W 5%	R23, R32			
23	471-0102	10		RES 1K OHM 1/2W 5%	R4, R5, R8, R14, R22, R35, R45, R55, R72, R48			
24	471-0103	16		RES 10K OHM 1/2W 5%	R10, R12, R13, R25, R43, R46, R50, R56-R60, R64, R67, R68, R75			
25	471-0104	17		RES 100K OHM 1/2W 5%	R15-R21, R24, R34, R38, R41, R42, R62, R65, R69, R71, R76			
26	471-0105	3		RES 1 MEG OHM 1/2W 5%	R3, R70, R77			
27	471-0124	4		RES 120K OHM 1/2W 5%	R47, R51, R63, R66			
28	471-0153	2		RES 15K OHM 1/2W 5%	R1, R2			
29	471-0154	1		RES 150K OHM 1/2W 5%	R39			
30	471-0220	1		RES 22 OHM 1/2W 5%	R49			
31	471-0224	1		RES 220K OHM 1/2W 5%	R40			
32	471-0394	8		RES 390K OHM 1/2W 5%	R26-R31, R44, R73			
33	471-0472	3		RES 4.7K OHM 1/2W 5%	R36, R52, R74			
34	471-0473	1		RES 47K OHM 1/2W 5%	R33			
35	471-0474	2		RES 470K OHM 1/2W 5%	R9, R11			
36	471-0682	2		RES 6.8K OHM 1/2W 5%	R53, R54			
37	475-0006	2		POT 100K	R6, R7			
38	481-0006	8		DIODE 1N914/1N4148	D1-D8			

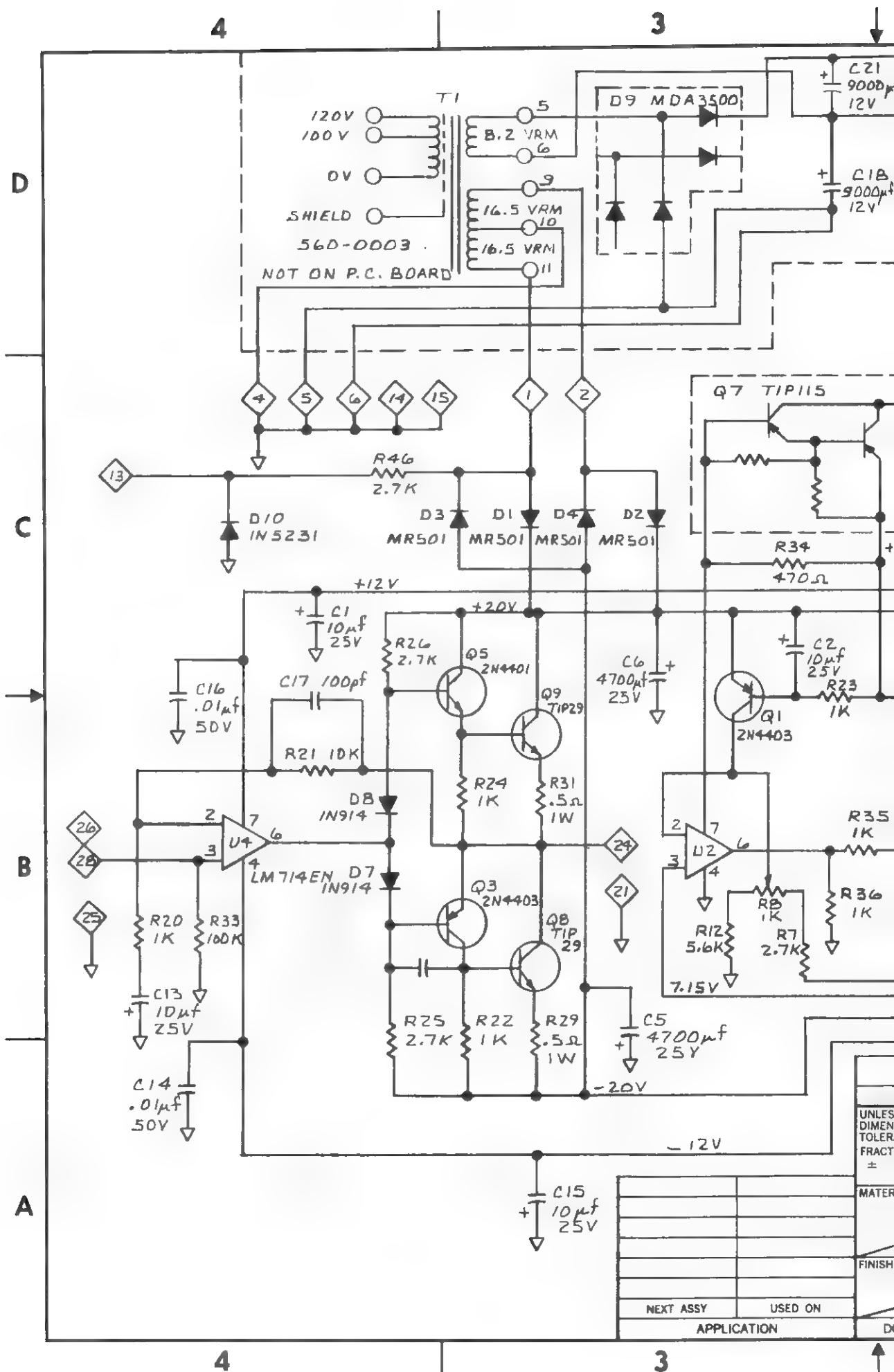




WIRING # B07-0010

		QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
		PARTS LIST			
		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.	<b>Grenlin Industries, Inc.</b> <b>San Diego, California 92122</b>
FRACTIONS	DECIMALS	ANGLES		APPROVALS	DATE
±	.XX ±	° ±		DRAWN BY <i>H. H. H.</i>	12-13-79
MATERIAL				CHECKED <i>[Signature]</i>	1-2-80
FINISH					
NEXT ASSY	USED ON	APPLICATION		DO NOT SCALE DRAWING	SIZE CODE IDENT NO. DRAWING NO. <b>D</b> <b>73-1-16</b>
				SCALE <b>NONE</b>	SHEET <b>5 OF 5</b>

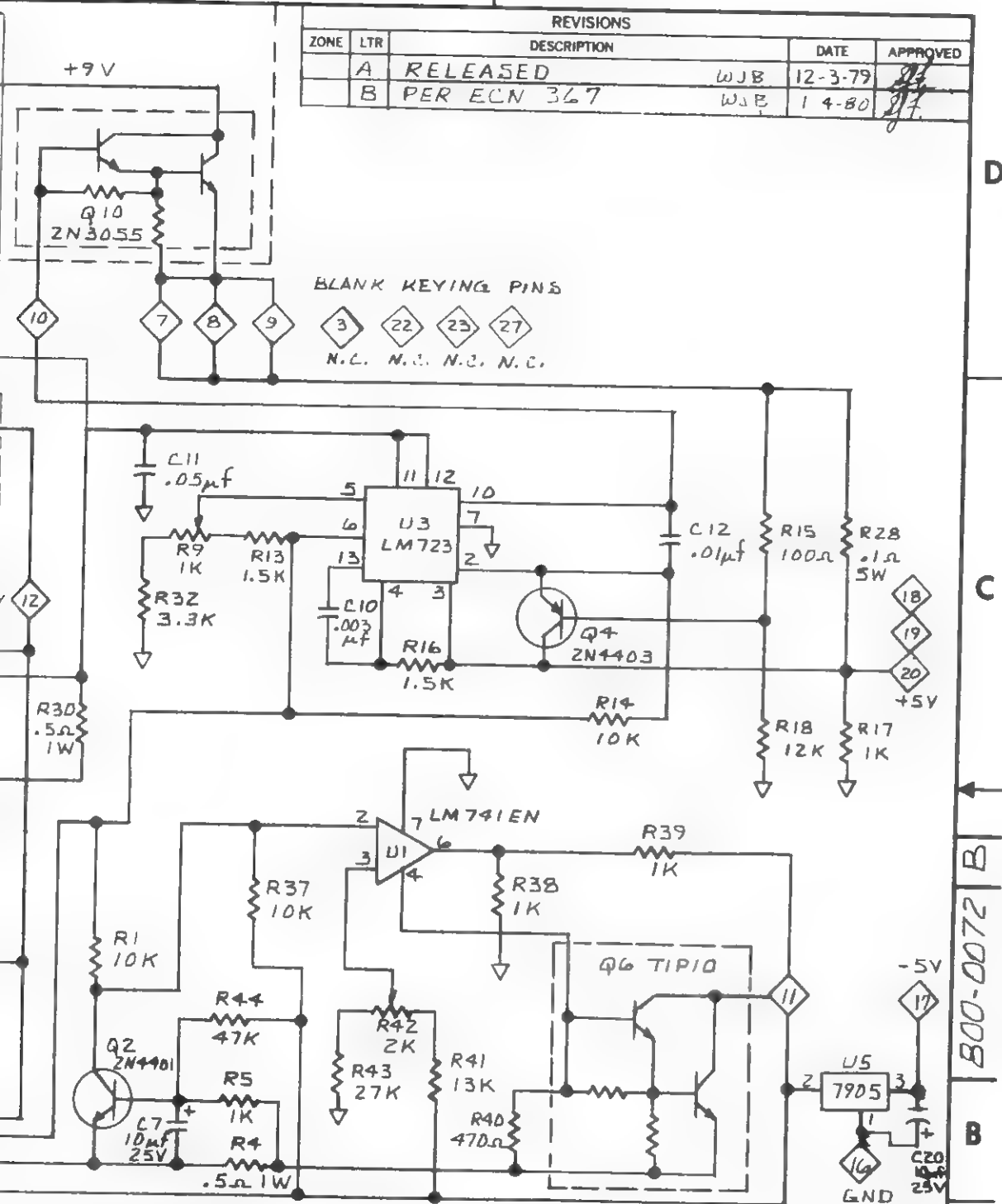
**WIRING DIAGRAM  
HEAD ON 2 / INVINCO**





2

1



Y	CODE	PART OR	NOMENCLATURE
QD	IDENT	IDENTIFYING NO.	OR DESCRIPTION
PARTS LIST			
CONTRACT NO.		Gromin Industries, Inc. San Diego, California 92123	
APPROVALS		DATE	
DRAWN Wynema		12-3-79	
CHECKED [Signature]		12-3-79	
SCHEMATIC — POWER SUPPLY DUAL GAMES		REV B	
SIZE C	CODE IDENT NO.	DRAWING NO. 800-0072	REY B
SCALE NONE		SHEET 4 OF 4	

2

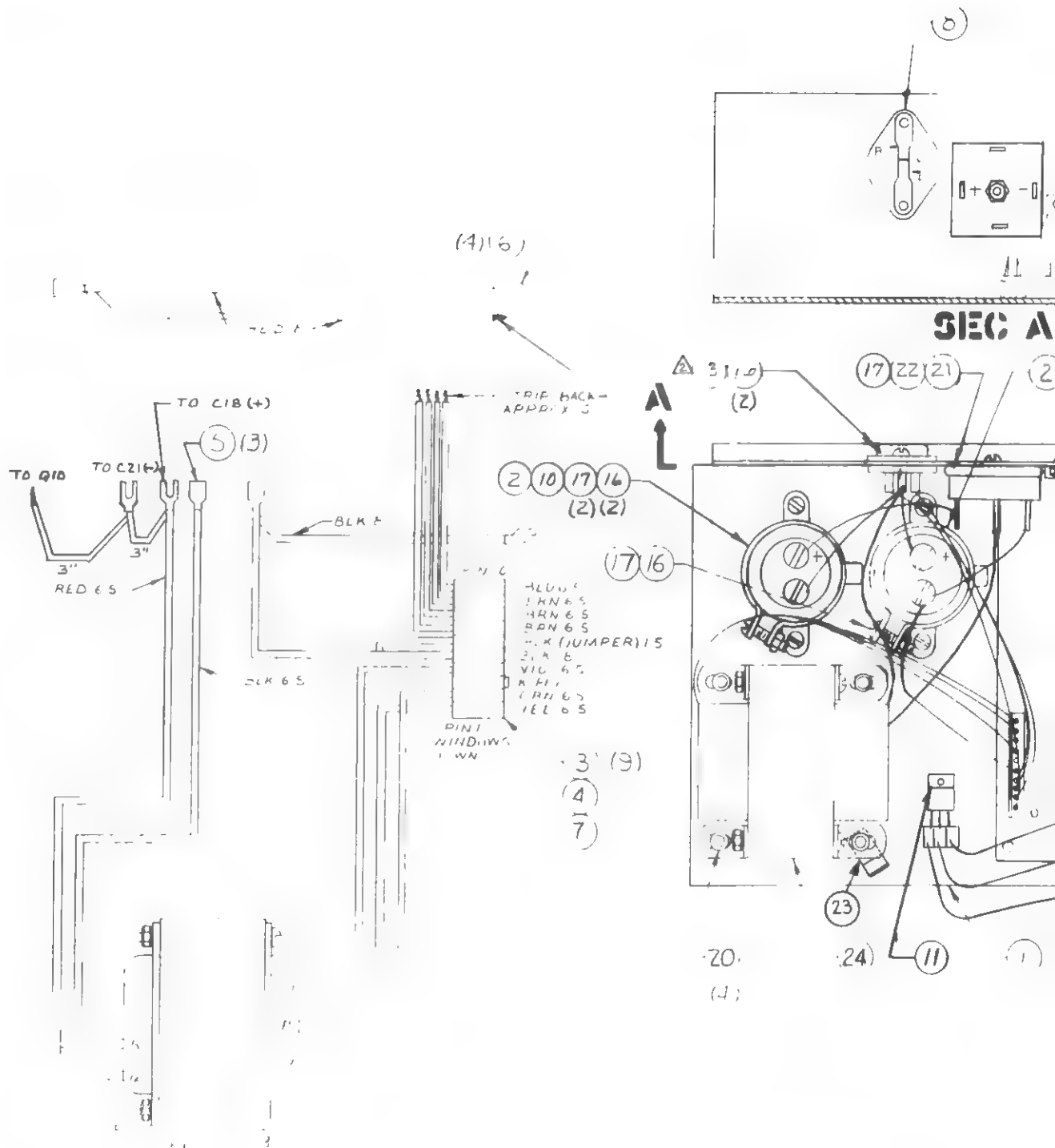
1

D

C

B

A



POWER WIRE SHALL START TO BE MOUNTED WITH  
ELECTRIC TAPPING PASTE & INSULATING HARDWARE  
WIRE TO BE AWG #22 GA

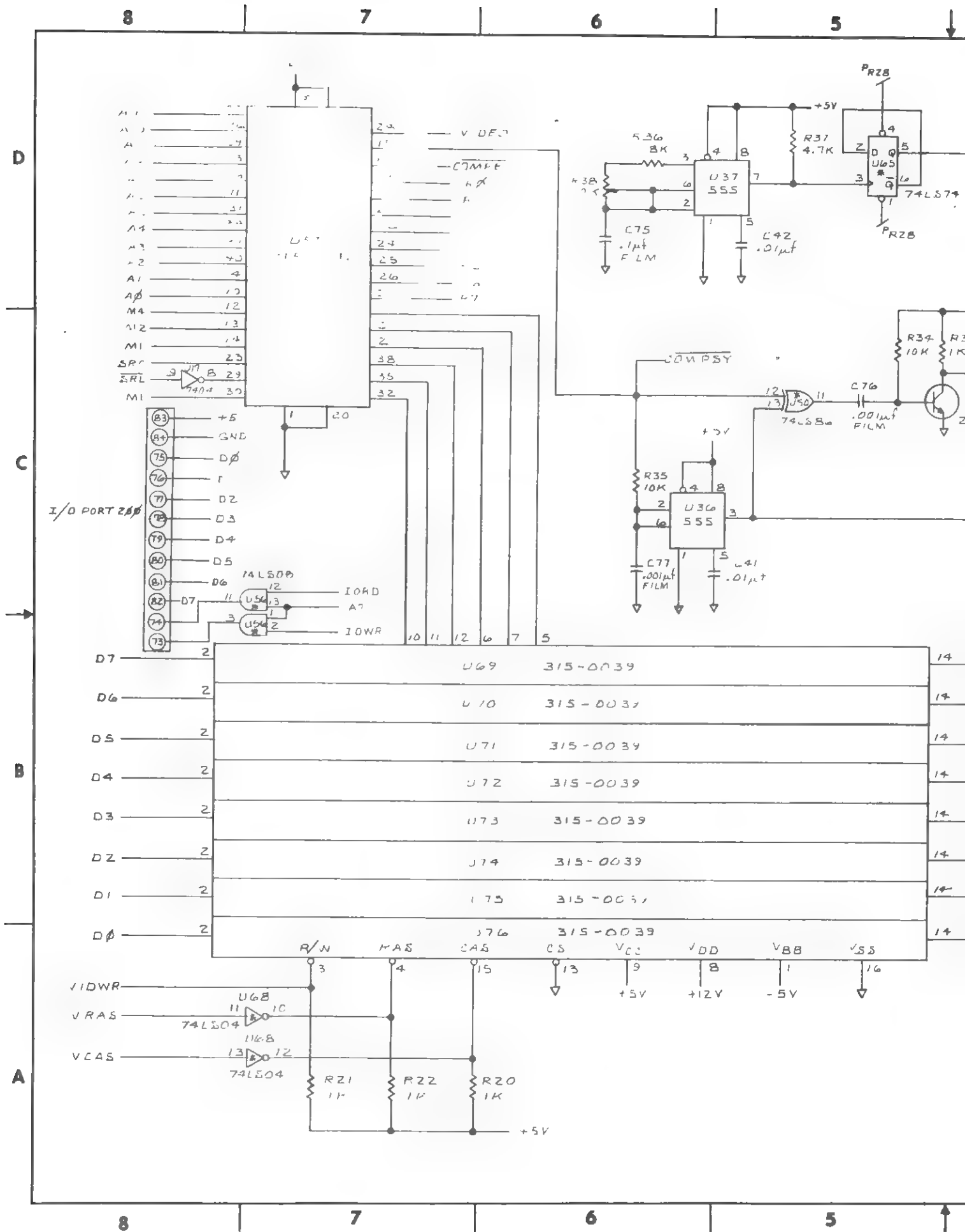
NOTE: UNLESS OTHERWISE SPECIFIED

1

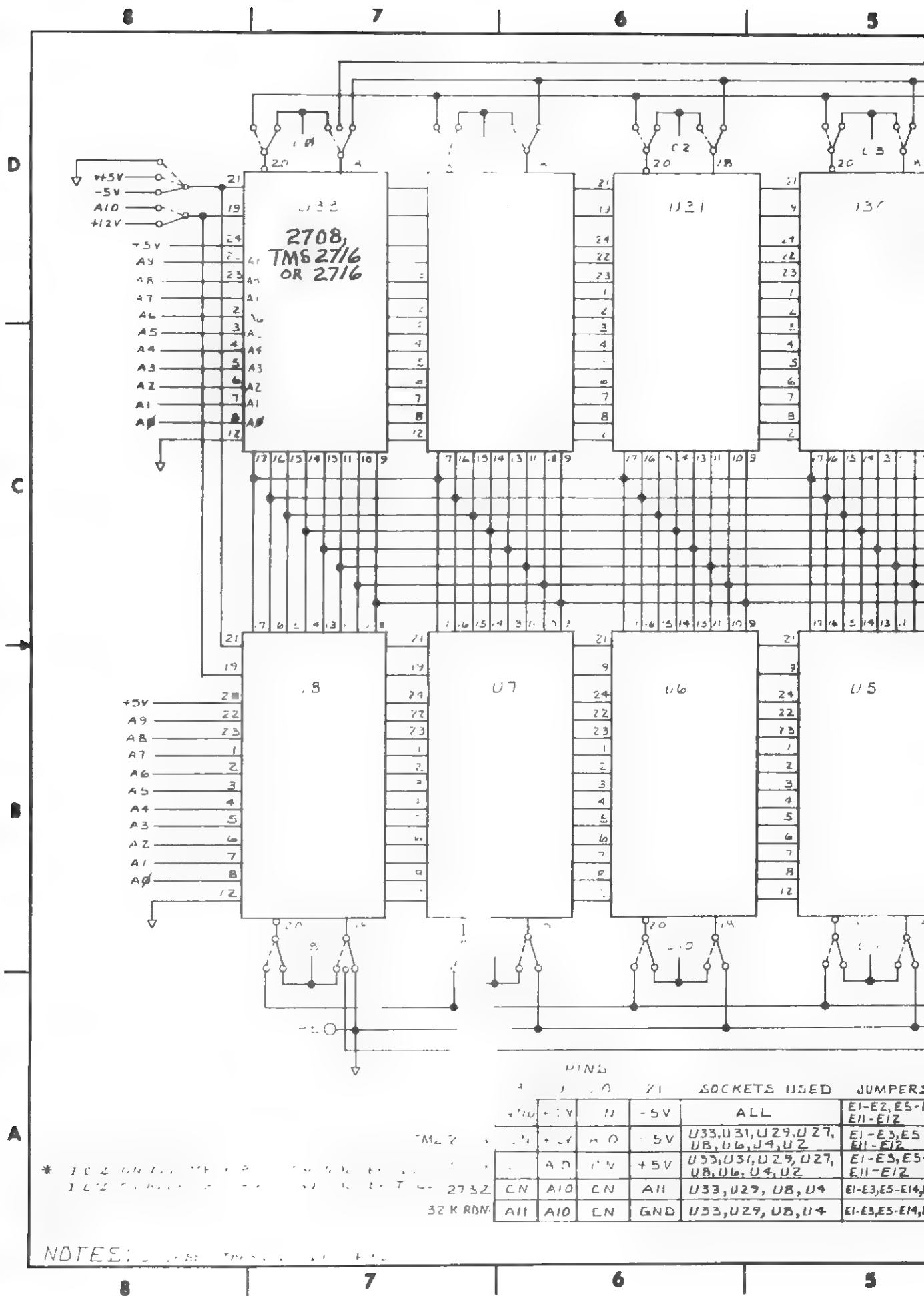


14

1





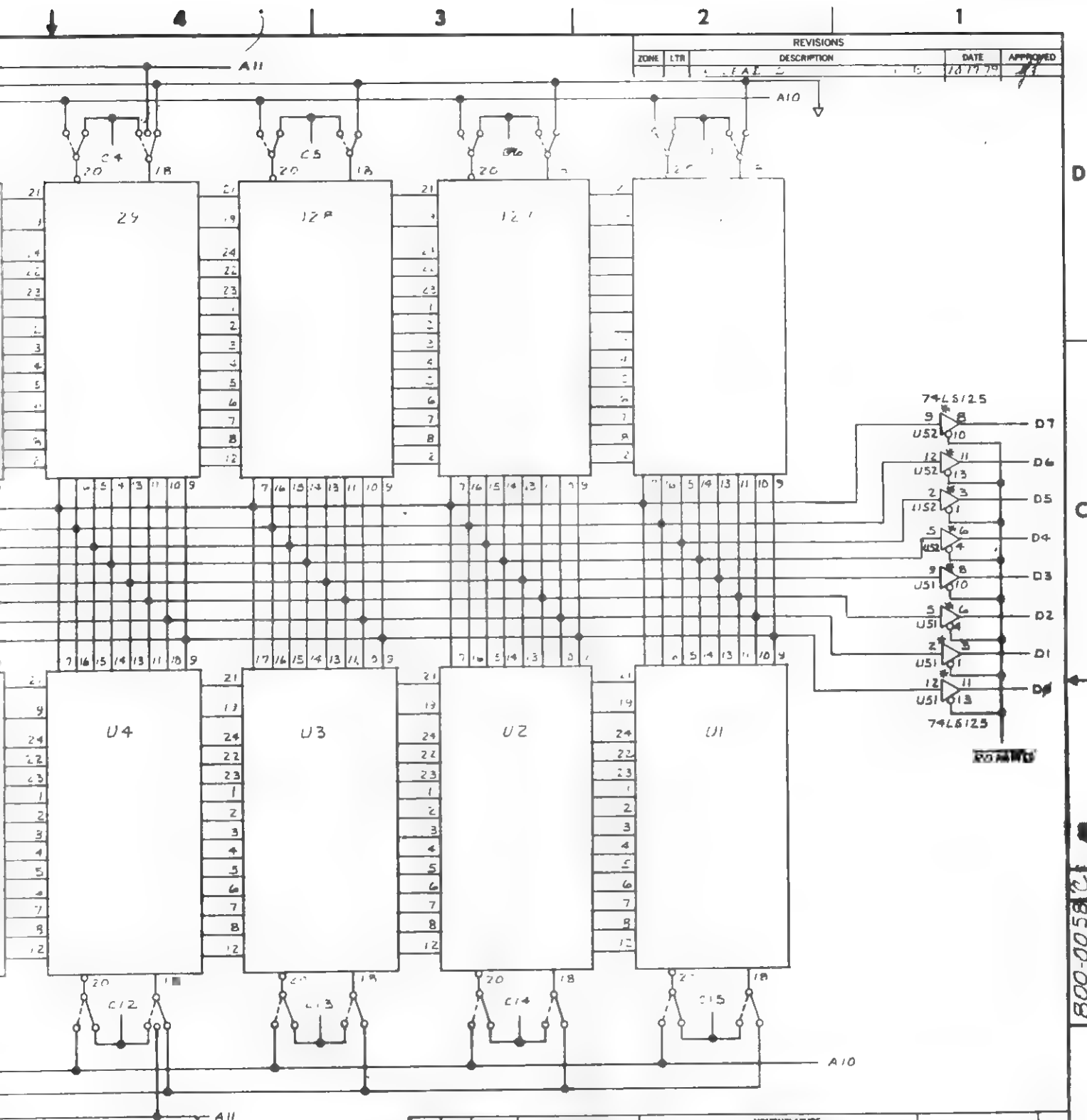


PINS				SOCKETS USED		JUMPERS
+	+	+	+	ALL		E1-E2, E5-E11-E12
+	+	+	+	U33, U31, U29, U27, U8, U6, U4, U2		E1-E3, E5-E11-E12
+	+	+	+	U33, U31, U29, U27, U8, U6, U4, U2		E1-E3, E5-E11-E12
CN	A10	CN	A11	U33, U29, U8, U4		E1-E3, E5-E11-E12
A11	A10	CN	GND	U33, U29, U8, U4		E1-E3, E5-E11-E12

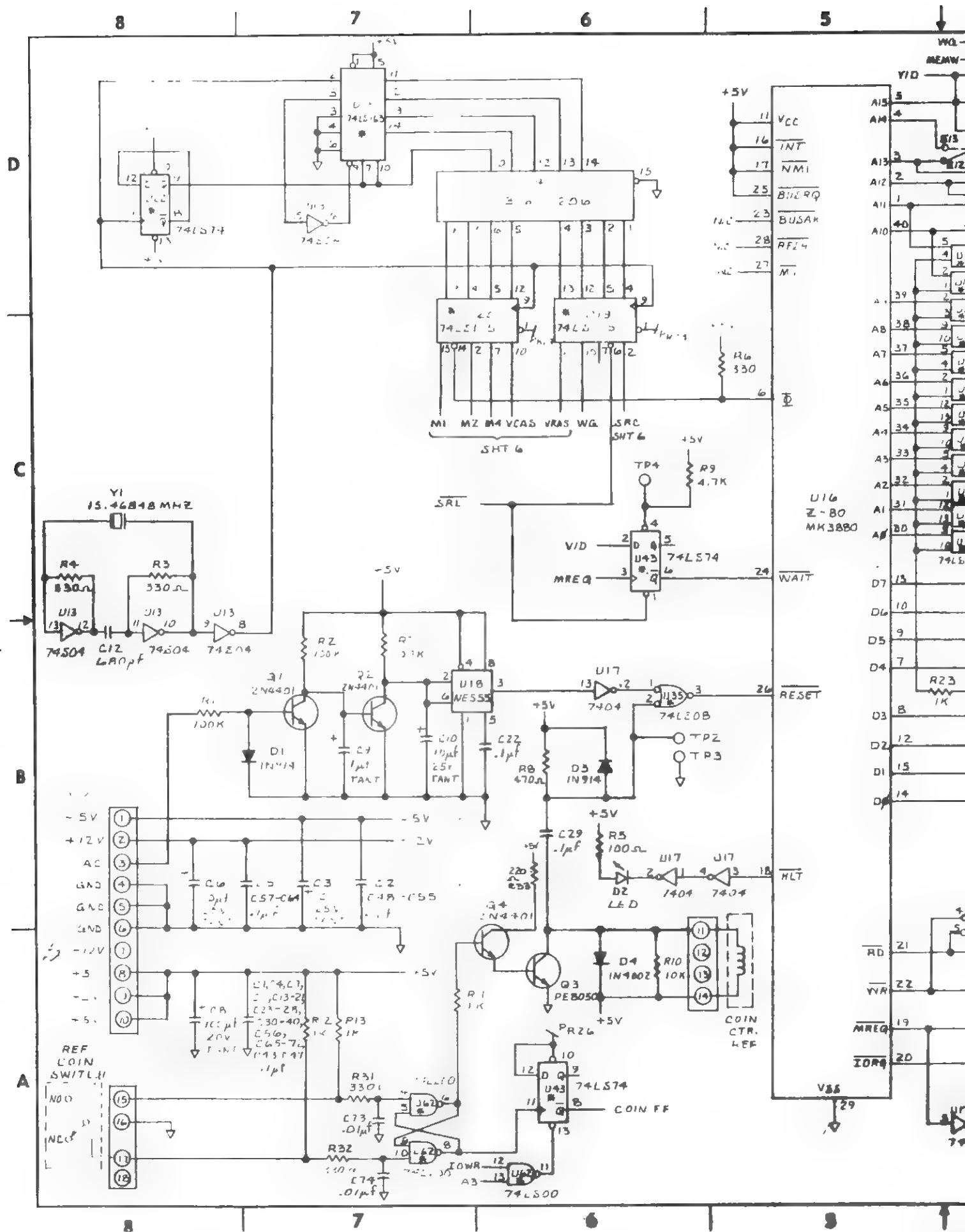
\* 102 OHM 1% TYP. 1/4W 250V  
 102 OHM 1% TYP. 1/4W 250V  
 32 K RDN

NOTES: 1. U32, U31, U3, U2, U7, U6, U8, U5

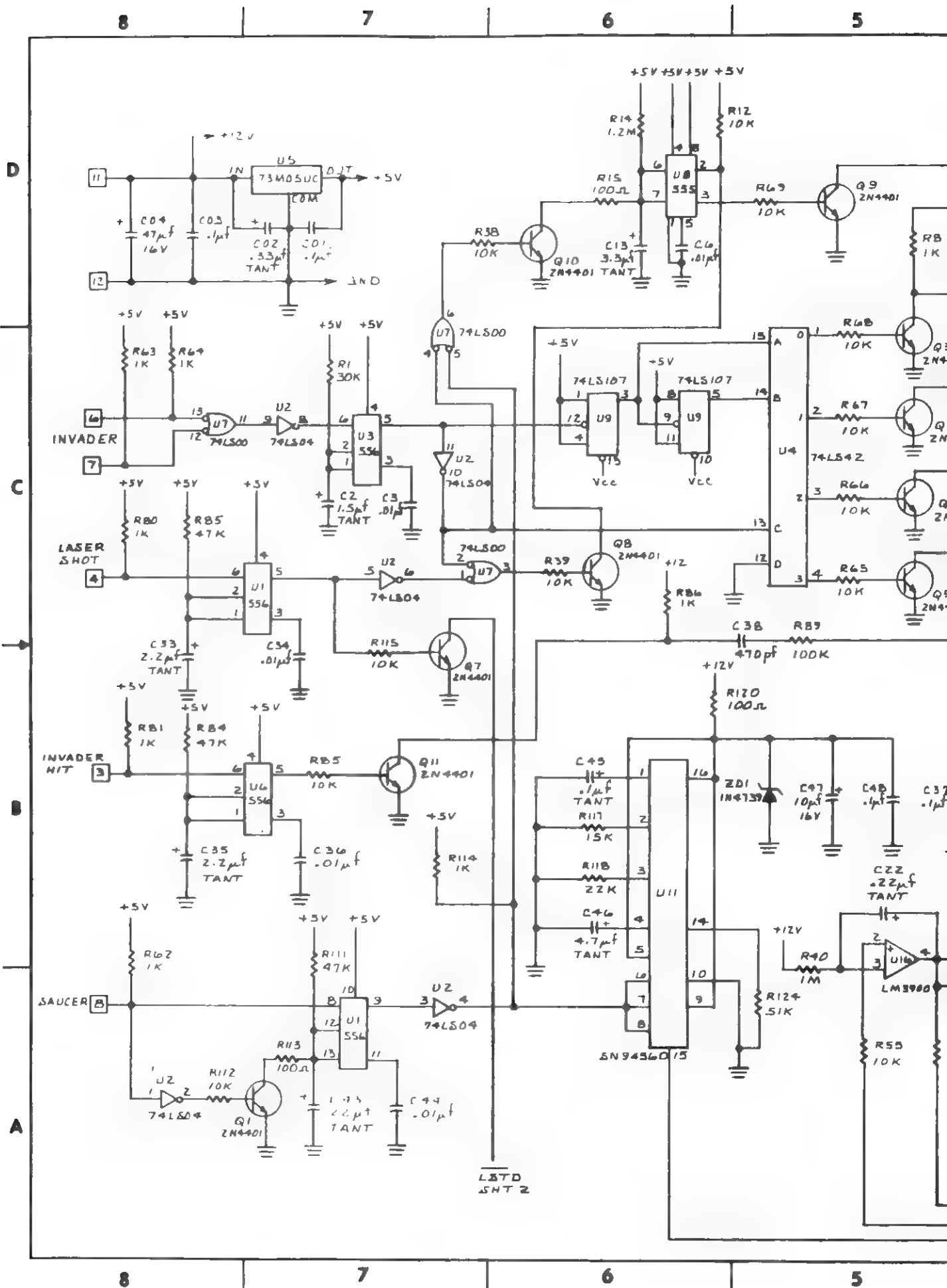


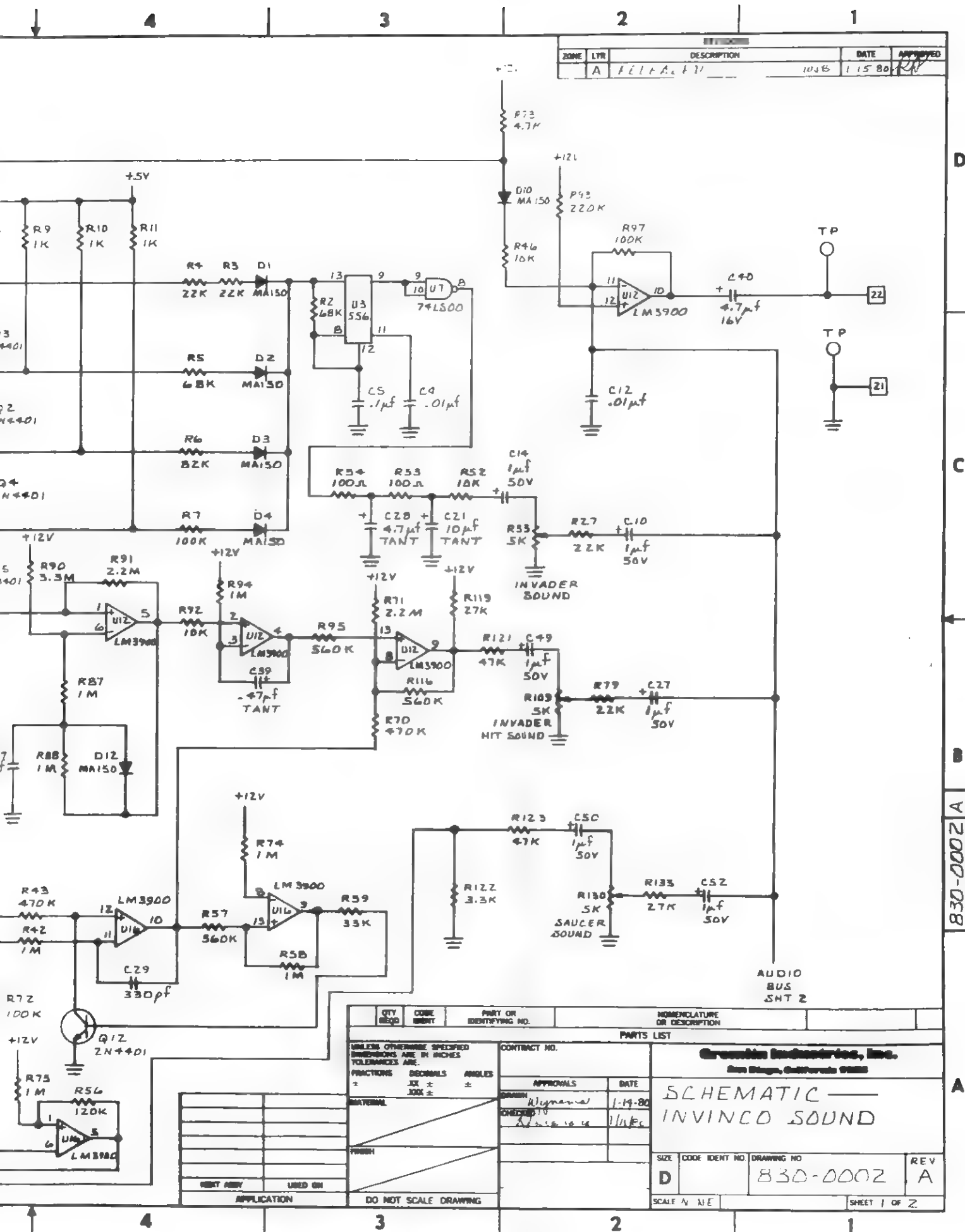


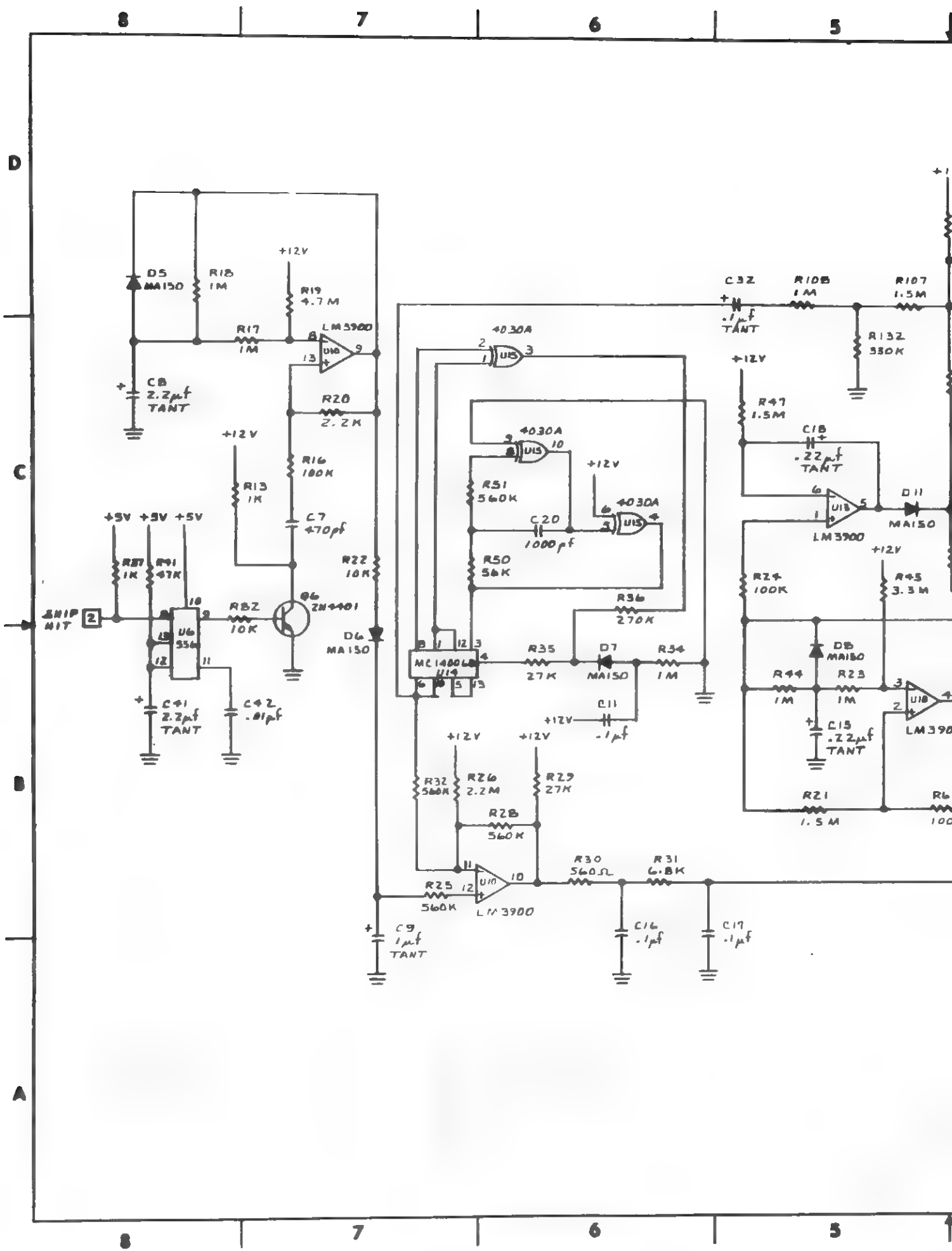
QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION		
PARTS LIST					
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.		Greenlin Industries, Inc. San Diego, California 92101	
FRACTIONS DECIMALS ANGLES		APPROVALS DATE		SCHEMATIC —	
± .XX ± ° ±		DRAWN <i>W. J. J.</i> 1/20/78		DUAL CAM V.I.C.	
DECIMAL		CHECKED <i>Don J. J.</i> 1/29/78			
POWDER				SIZE CODE IDENT NO DRAWING NO REV	
				D 855-0008 24	
DO NOT SCALE DRAWING		SCALE NONE		SHEET 7 of 8	

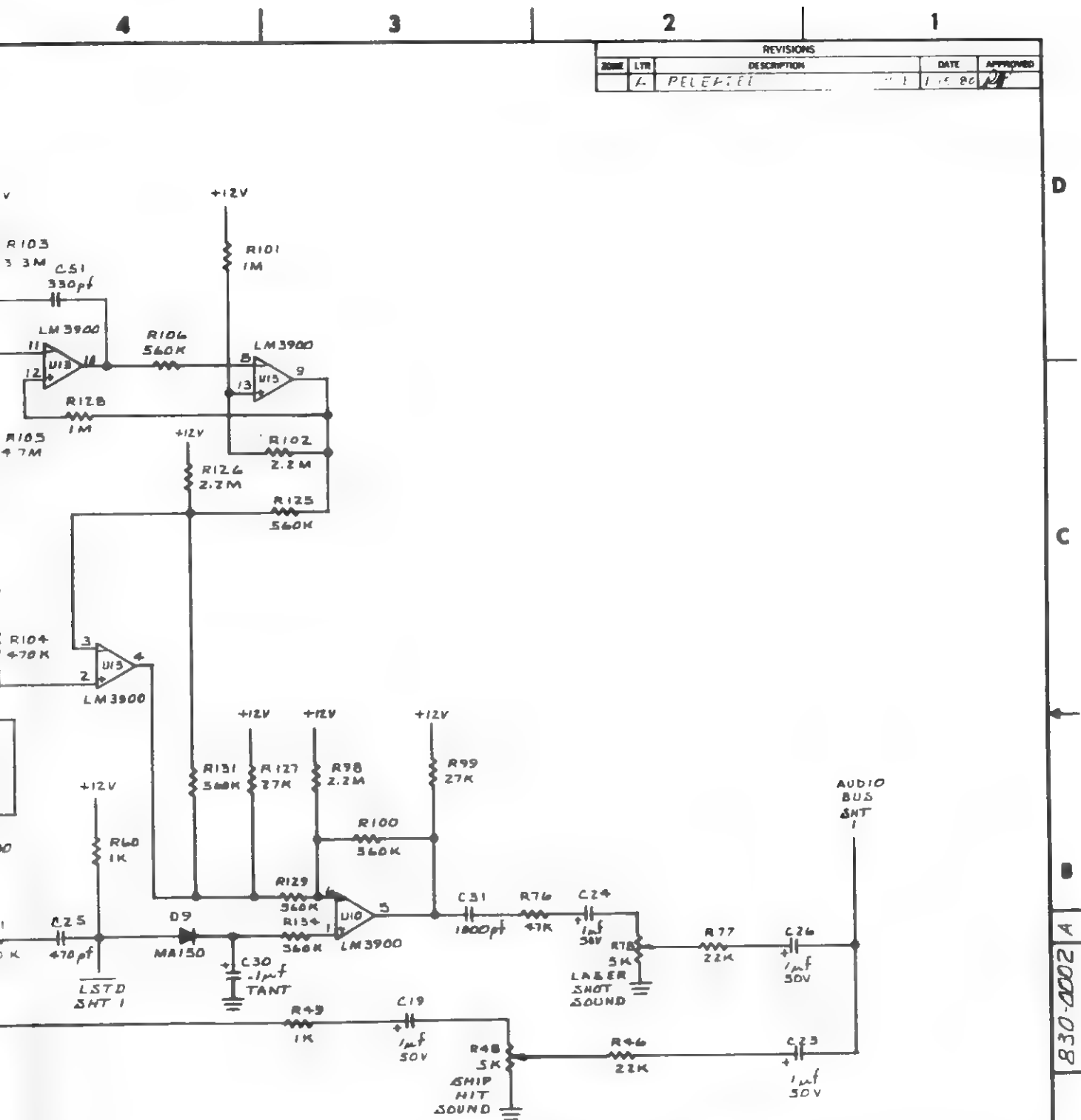








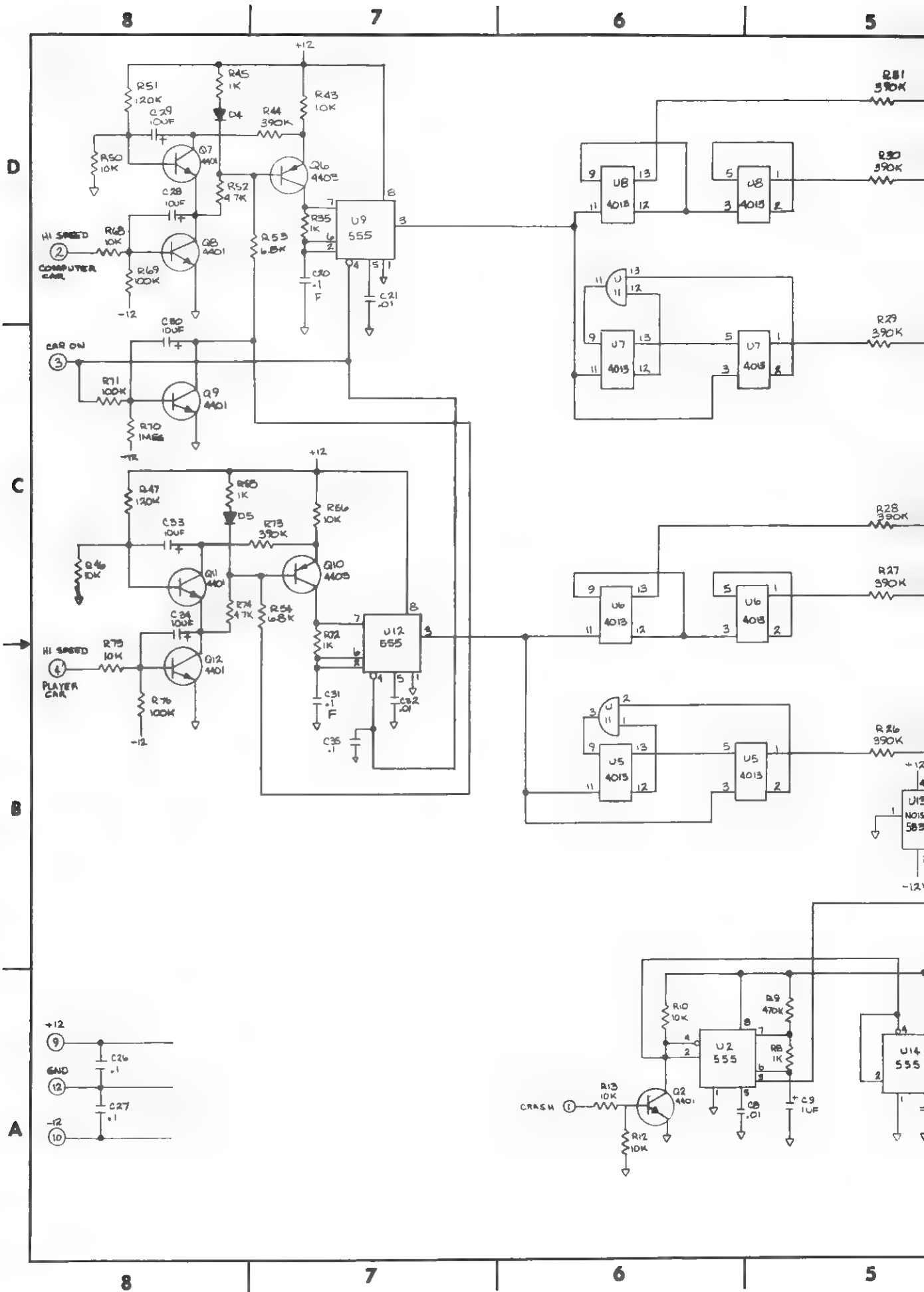




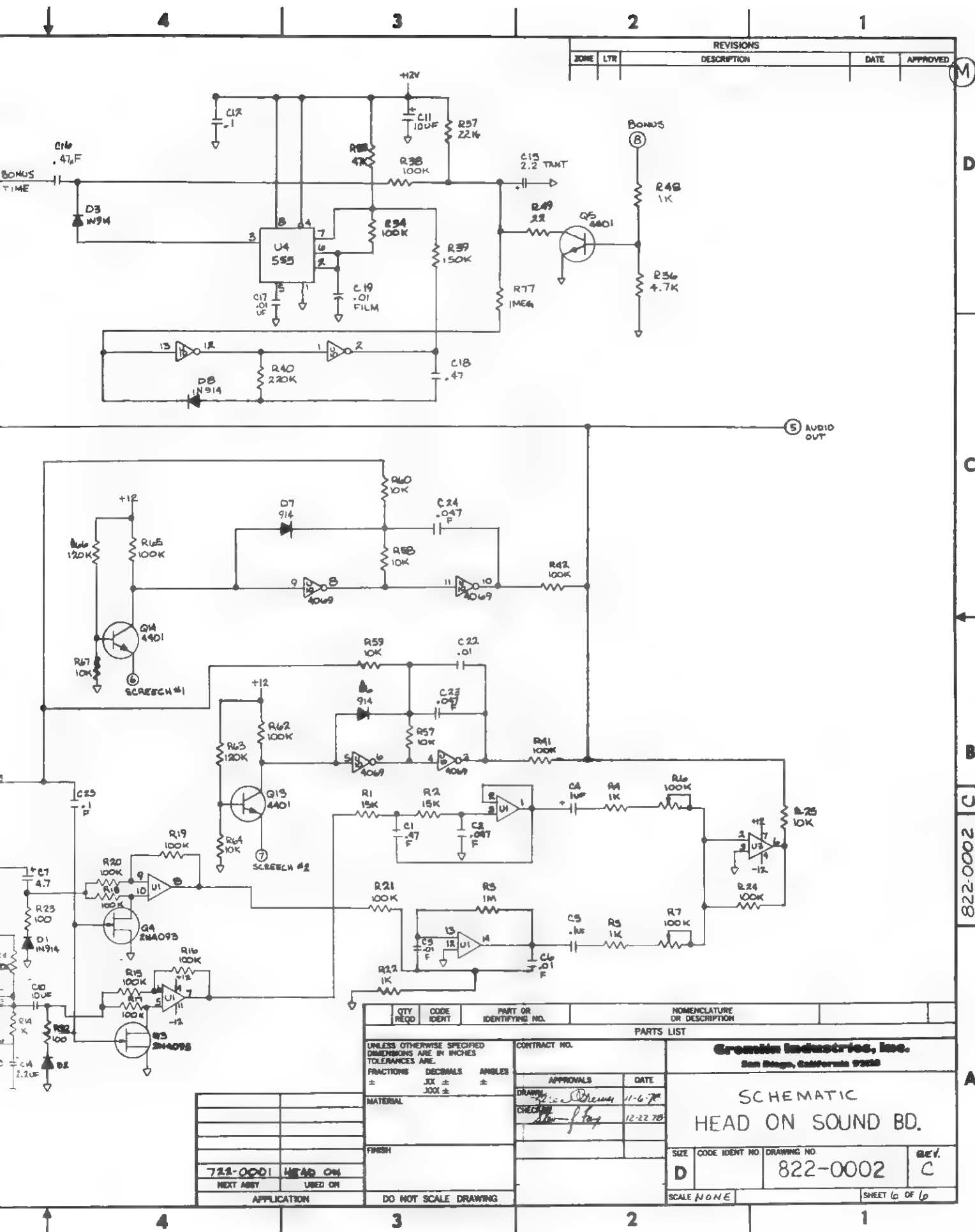
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
1	L	PELEP:EE	1/14/80	[Signature]

QTY	CODE	PART OR IDENTIFYING NO.	NUMERICAL OR DESCRIPTION
PARTS LIST			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		<b>Gromm Industries, Inc.</b> San Diego, California 92108	
FUNCTION	QUANTITY	APPROVAL	DATE
		[Signature]	1/14/80
SCHEMATIC —		INVINCO SOUND	
SIZE	CODE	QTY	REL. DRAWING NO.
D			830-0002
SCALE NINE		SHEET 1 OF 1	

830-0002 A







8

7

6

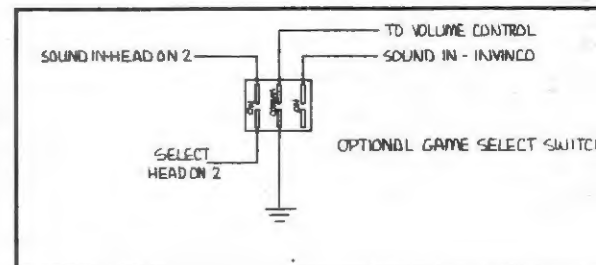
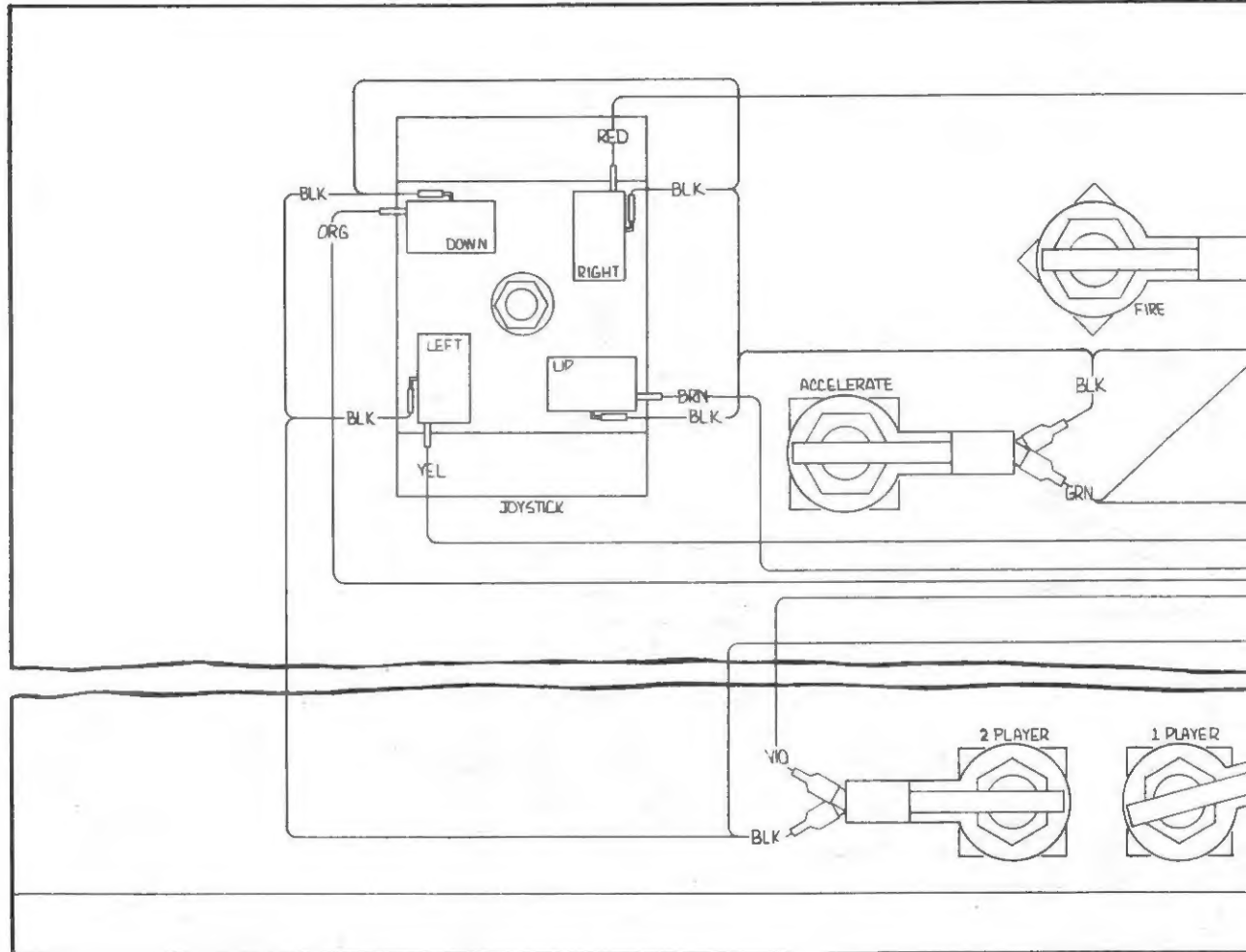
5

D

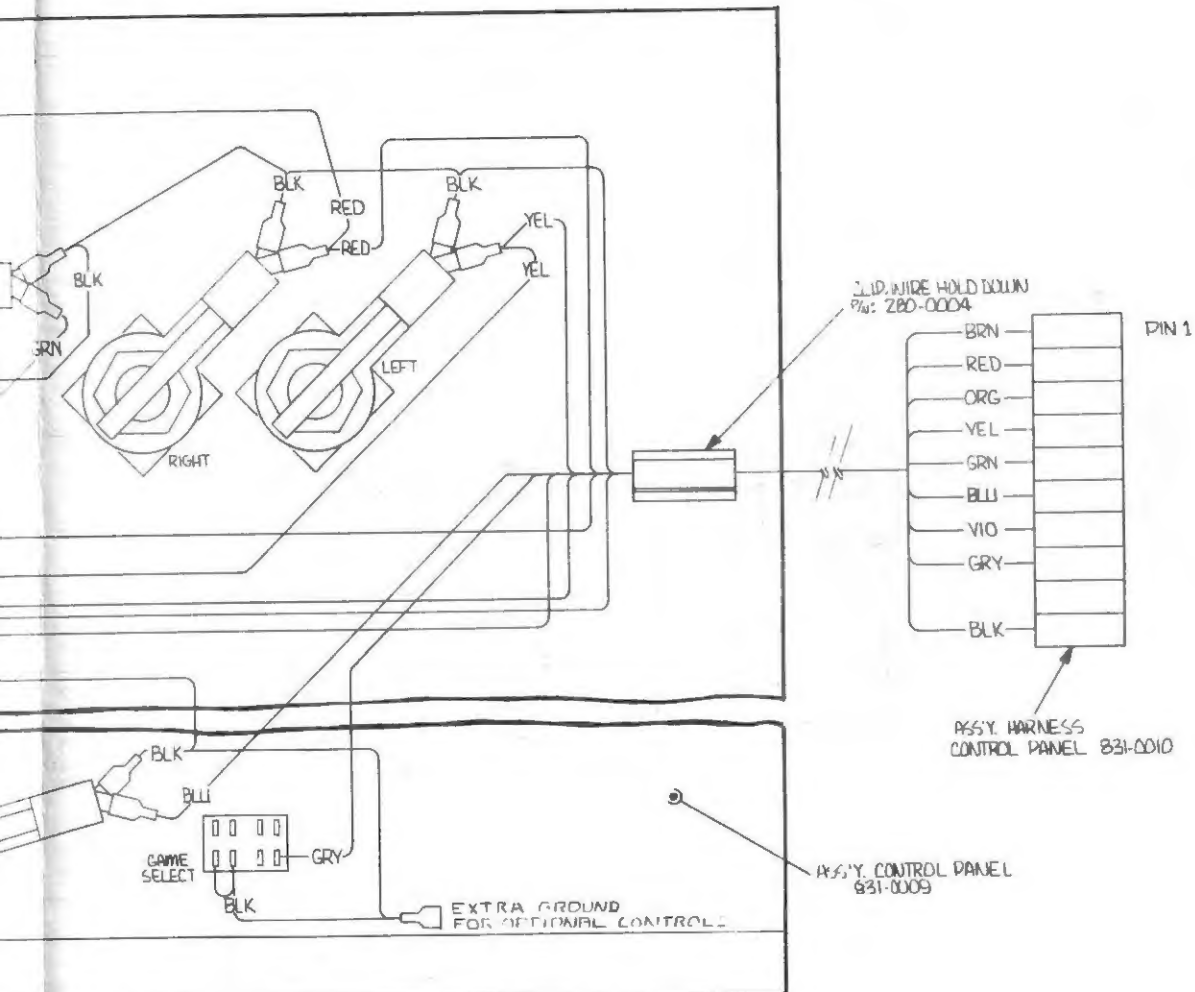
C

B

A



4		3		2		1	
				REVISIONS			
ZONE		LTR		DESCRIPTION		DATE	APPROVED
		A		RELEASED		12 28 79	



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.	
FRACTIONS ±	DECIMALS .XX ± .XXX ±	ANGLES ±	
MATERIAL		APPROVALS	DATE
NOTED		DRAWN <i>Rin H. H. H.</i>	12 28 79
FINISH		CHECKED <i>[Signature]</i>	12 28 79
NEXT ASSY		USED ON	
APPLICATION		DO NOT SCALE DRAWING	
		Gremlin Industries, Inc. San Diego, California 92123	
		ASSY. CONTROL PANEL COMPLETE HEAD ON 2 / INVINCO	
		SIZE D	CODE IDENT NO. 831-0008
		DRAWING NO. 831-0008	
		REV. A	
		SCALE 1:1	
		SHEET 1 OF 1	

D

C

B

A

831-0008

A

